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## NEW CLAUSILIIDÆ OF THE JAPANESE EMPIRE.—X.

BY HENRY A. PILSBRY.

In this tenth<sup>1</sup> article upon Japanese *Clausiliidæ*, the species discovered by Mr. Nakada in the Ryukyu Islands and by Mr. Azuma in Satsuma and its islands, are dealt with, together with a few forms from other parts of the empire. The two collectors mentioned, working under Mr. Hirase's direction, have about doubled the number of land mollusks known from the Ryukyu Islands. Tokunoshima has proved particularly rich. The transition from the Ryukyuan fauna to that of Japan proper is found in Yakushima and Tanegashima, Ōsumi, and in the Koshikijima group, south of Satsuma. In these islands there is a strong Ryukyuan strain, but the Kyushu faunal element predominates.

In the Ryukyu group the *Clausiliidæ* are present in abundance. Except *Stereophædusa*, none of the Japanese groups are represented, the species I formerly referred to *Hemiphædusa* being so far specialized that they may more properly be segregated as separate groups. *Luchuphædusa* and the Zaptychoid forms predominate. Some of them are wonderfully specialized. *Diceratoptyx*, for instance, has almost lost the lunella, which remains as a minute vestige only; the lower palatal plica has been crowded upward, and its place taken by the dilated subcolumellar lamella. *Oligozaptyx* and some Luchuphædusas are almost equally modified in other directions. As a whole, the *Clausiliidæ* are more specialized than those of either China or Japan, and bear out the proposition I have elsewhere advanced, that insular faunas age more rapidly than those of larger or continental areas.

## HEMIPHÆDUSOID PHYLUM.

Section MEGALOPHÆDUSA Bttg.

*Clausilia ducalis rex* n. subsp.

Larger and especially wider throughout than *C. ducalis*; superior lamella contiguous to the spiral lamella, but not united with it; prin-

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<sup>1</sup> Seven papers have appeared under the title "Additions to the Japanese Land Snail Fauna," Parts II to VIII; one as "Catalogue of Clausiliidæ of the Japanese Empire," and one, "Land Mollusks of the Loo Choo Islands, Clausiliidæ." All were published in these *Proceedings*, 1900 to 1903.

cipal plica short; upper palatal plica short but well developed, a low ridge (lunella) below it.

Length 42, diam. 9 mm.; whorls 11.

Length 39, diam. 9 mm.; whorls 10.

Amagisan, Izu. Types No. 85,730, A. N. S. P., from No. 1,139 of Mr. Hirase's collection.

*Clausilia cymatodes* n. sp. Pl. LIV, figs. 29, 30, 31, 32, 33.

Shell rimate, strong, the last two whorls of about equal diameter, occupying over half the length of the shell, those above rapidly tapering, somewhat attenuate toward the apex. Yellowish-brown.

Surface glossy, sculptured with coarse strong somewhat irregular ribs, rapidly decreasing to striae on the spire, the early whorls smooth from wear. Whorls  $10\frac{1}{2}$ , convex, the last flattened laterally. The aperture is rhombic-ovate, vertical. Peristome continuous, rather broadly reflexed and thickened within. Superior lamella marginal, rather high, continuous with the spiral lamella, which penetrates to a point above the superior lamella. Inferior lamella low and receding, thick below, obliquely ascending, as long inside as the spiral lamella. Subcolumellar lamella emerging. Principal plica dorsal and lateral, extending past the palatal plicæ, of which there are three, lateral in position.

Length 22, diam. 5 mm.

Length 21, diam. 4.7 mm.

*Clausilium* (Pl. LIV, figs. 29, 30, 31) narrow and parallel-sided, obtuse and obliquely rounded at the apex, bluntly angular in the middle of the palatal margin, not excised near the filament.

Tajironura, Ōsumi. Types No. 87,610, A. N. S. P., from No. 1,249 of Mr. Hirase's collection.

This rib-striate little *Megalophædusa* is related to *C. hiraseana*. It differs in being much smaller, light colored, not quite so coarsely sculptured, with emerging subcolumellar lamella. *C. nagashimana* of the neighboring province Satsuma is more closely related, but that is also a large dark form. Both of these species differ widely from *C. cymatodes* in the shape of the clausilium, which in *cymatodes* is very obtuse at the distal end. The number of palatal plicæ will probably prove to be variable.

*Clausilia nagashimana* n. sp. Pl. LIV, figs. 25, 26, 27, 28.

The shell is similar to *C. hiraseana* Pils., but it is much more finely sculptured, and the superior lamella does not reach the margin.

Length 28, diam 6.6 mm.; whorls about  $11\frac{1}{2}$ .

The clausilium (Pl. LIV, figs. 27, 28) is long and narrow, attenuated distally, and not excised near the filament.

Nagashima, Satsuma. Types No. 87,607, A. N. S. P., from No. 1,243 of Mr. Hirase's collection.

The type specimen is colored like *C. hiraseana*; the superior is continuous with the spiral lamella, and the subcolumellar lamella emerges, though it does not reach the lip-edge.

Another specimen, evidently from a more moist locality, is eroded, dull whitish, partially overgrown with green algae. The subcolumellar lamella is immersed, and the superior lamella is separated from the spiral. The clausilium is like that of *C. hiraseana*. Without a larger series of specimens it is impossible to tell whether this represents another race or not.

#### Section HEMIPHÆDUSA Bttg.

*Clausilia ventriluna* n. sp. Pl. LV, figs. 58, 59, 60.

Shell slender, fusiform, attenuated toward the apex; rather solid and strong; brown, somewhat glossy; very closely and finely striate, the striæ a little closer on the back of the last whorl. Whorls 9½ or 10, the first one globose, sometimes self-amputated. The attenuated early whorls are very convex, the later ones less so, and the last whorl is somewhat flattened laterally, with a noticeable impression marking the position of the principal plica. The aperture is trapezoidal-ovate, somewhat oblique, the peristome reflexed, slightly thickened, continuous and well raised across the parietal wall. The superior lamella is small, marginal and oblique, continuous with the spiral lamella, which is very high within and penetrates across the ventral side. The inferior lamella recedes deeply, and within the back ascends obliquely, and is nearly straight. It is far smaller and lower than the spiral lamella, but penetrates as deeply. The subcolumellar lamella emerges to the lip-edge. The principal plica is very long, reaching nearly to the peristome, and penetrating inward to a point above the sinulus. The lunella with the upper and lower palatal plicæ is shaped like the letter I, and is nearly ventral in position.

Length 15.7, diam. 3 mm.

Length 15.3, diam. 3.4 mm.

The clausilium (Pl. LV, figs. 58, 59) is long and narrow, parallel-sided, obliquely rounded distally, and very deeply excised on the columellar side of the filament.

Yasuda-mura, Tosa. Types No. 87,576, A. N. S. P., from No. 1,011 of Mr. Hirase's collection.

In this *Hemiphædusa* of the group of *C. aulacophora* the plicæ and lamellæ penetrate very deeply—across the ventral side—and the lunella stands in a ventral position, above the columellar margin of the peristome. In *C. aulacophora* and *C. pigra* the lunella is lateral, but of the same shape. *C. ventriluna* is very closely related to *C. caryostoma* and *C. c. jayi*, which have the armature similarly deep-seated; but neither of these forms has a perfect lunella uniting the two palatal plicæ.

The clausilium is not thickened distally as in *Tyrannophædusa*, but otherwise *C. ventriluna* has much in common with *C. (Tyr.) aurantiaca*.

Other specimens from Tsushima, Awa (Shikoku), are smaller than those from Yasuda-mura, and the superior lamella is either separated from the spiral lamella or but weakly connected therewith. The principal plica is a little shorter inside. In some of the specimens the subcolumellar lamella emerges to the lip-edge, and is bounded by furrows. In others it is immersed or very feebly and slightly emerges. These shells are No. 1,187 of Mr. Hirase's collection.

*Clausilia ikiensis* n. sp. Pl. LV, figs. 45, 46, 50, 51.

Shell small, fusiform, dark or pale reddish-brown, somewhat shining, weakly striatulate, the last whorl becoming densely and finely striate on the back. Spire decidedly attenuate above. Whorls  $9\frac{1}{2}$ , convex, the last somewhat flattened peripherally. Aperture rhombic-ovate, somewhat oblique, the peristome continuous, reflexed and somewhat thickened within; the parietal margin well raised, straight or a little emarginate over the superior lamella. Superior lamella slightly oblique, compressed, marginal, continuous with the spiral lamella, which extends inward scarcely to the middle of the ventral side. Inferior lamella deeply receding, straightly ascending within the back, not penetrating quite so deeply as the spiral lamella. Subcolumellar lamella very weakly emerging. Principal plica not long, dorsal and lateral. Upper palatal plica short, united in the middle to the oblique, narrow lunella, which curves inward below. *Below the lower end of the lunella there is a short, straight lower palatal plica.*

Length 12, diam. 3 mm.

Length 11.5, diam. 2.8 mm.

The clausilium (Pl. LV, figs. 50, 51) is parallel-sided, rounded distally, and deeply excised on the columellar side of the filament. It is decidedly arcuate.

Mushōzumura, Iki. Types No. 86,063, A. N. S. P., from No. 1,088 of Mr. Hirase's collection.

This *Hemiphædusa* is structurally similar to species of the group of

*C. awajiensis*, except in having a lower palatal plica distinct from the lunella—a structure not found in any other known species of that group. The lower end of the lunella curves inward less than in most species of the group of *C. awajiensis*. It has some characters of *Hemizaptyx*.

***Clausilia platydera* var. *minoensis* nov.**

Shell smaller than *platydera*, with the last whorl built forward, carrying the aperture shortly free. Upper palatal plica rather long, arcuate, making an angle with the lunella instead of being merely a short curve continuous with the latter. The subcolumellar lamella is immersed or weakly emerges.

Length 18, diam. 3.9 mm.

Length 18, diam. 3.5 mm.

Length 15, diam. 3.3 mm.

Minakamimura, Mino. Types No. 86,468, A. N. S. P., from No. 1,172 of Mr. Hirase's collection.

***Clausilia mikawa* n. sp. Pl. LIV, figs. 39, 40, 41.**

Shell subcylindric below, tapering above, the spire moderately attenuate and rather thick, the four or five upper whorls widening very little, then the intermediate whorls increase rapidly. Thin, pale greenish-yellow, imperfectly translucent. Sculpture of nearly regular, oblique and fine rib-striæ, the intervals very finely striate spirally. The sculpture is not noticeably coarser on the back of the last whorl. Apex obtuse. Whorls 11, convex. Aperture subvertical, widely ovate, the peristome white, narrowly reflexed, somewhat thickened within, adnate above, but continuous in a slightly raised ledge across the parietal wall. Superior lamella small and compressed, oblique, continuous with or contiguous to the spiral lamella, which penetrates to the middle of the ventral side. Inferior lamella receding, but visible as a rather sharp fold in the throat, slightly spiral as seen within the back, and penetrating a little deeper than the spiral lamella. Subcolumellar lamella immersed or weakly emerging. Principal plica short, dorsal and lateral. Palatal plicæ 3 or 4, visible through the shell, subequal or the intermediate 1 or 2 shorter.

Length 21 to 22, diam. 5 mm.

*Clausilium* thin and rounded distally, not excised near the filament.

Sanganeyama, Mikawa. Types No. 86,519, A. N. S. P., from No. 1,167 of Mr. Hirase's collection.

This pale and rather thin species is more distinctly decussate between the striæ than other forms known to me. It has the color of some

species of the group of *C. sublunellata*, but the sculpture is stronger and the palatal armature better developed. The smaller *C. decussata* Marts., from Tsukuba-san, Hitachi, may be related, but I have not seen that species. The spiral striae are not sufficiently indicated in fig. 41.

***Clausilia hosayaka* n. sp. Pl. LV, figs. 61, 62, 63.**

Shell slender, regularly tapering from the penultimate whorl, the upper third attenuate, apex obtuse; thin but moderately strong, light brown. Surface glossy, very finely striate. Whorls about  $13\frac{1}{2}$ , moderately convex, the last somewhat flattened on the back. Aperture small, oblique, squarish-piriform, the peristome reflexed, somewhat thickened within, continuous, the parietal margin shortly raised, and emarginate above the superior lamella. Superior lamella compressed, only slightly oblique, continuous with the spiral lamella, which penetrates to the middle of the ventral side. Inferior lamella receding, visible in the aperture as a small fold, straightly ascending within the back, penetrating a little further inward than the spirallamella. Subcolumellar lamella either emerging to the lip-edge or immersed. Principal plica short, chiefly dorsal. Upper palatal plica short, oblique, not connected with the very weak lateral lunella, which is obsolete below, and curves inward above or connects with a short, weak second palatal plica. There is no lower palatal plica.

Length 22.5, diam. 4.5 mm.

Length 21.5, diam. 4.3 mm.

Kamomura, Shima. Types No. 86,521, A. N. S. P., from No. 1,176 of Mr. Hirase's collection.

By its palatal armature this species belongs to the Hemiphædusañ group of *C. sublunellata*. It is readily distinguished from other known species of that group by the greater number of whorls and more slender spire. The lunella is very feebly developed, and probably will be found to be sometimes obsolete, as in some other species of the group.

***Clausilia koshikijimana* n. sp. Pl. LV, figs. 53, 54, 55, 56, 57.**

Shell fusiform, much attenuated above, very solid and strong; pale yellow, somewhat glossy, closely and finely striate. Whorls 9, the first quite small, the rest convex, the last whorl somewhat flattened. The aperture is ovate and projects shortly free; peristome white, reflexed and thickened within. The superior lamella is marginal, low and oblique, continuous with the spiral lamella, which penetrates to a point above the sinulus. The inferior lamella recedes deeply, is straight and oblique within, and thickened at the lower end. It does not pene-

trate quite so far as the spiral lamella. The subcolumellar lamella is deeply immersed. The principal plica is dorsal and lateral, approaching the lip. There is an oblique series of about 5 small, slender palatal plicæ situated upon a low ridge.

Length 14.3, diam. 3.4 mm.

Length 13, diam. 3.3 mm.

Length 11, diam. 3 mm.

The clausilium (Pl. LV, figs. 55, 56) is narrow, the distal half tapering to the rounded apex. It is moderately excised on the columellar side of the filament.

Shimo-Koshikijima, Satsuma. Types No. 87,604, A. N. S. P., from No. 1,239 of Mr. Hirase's collection.

A small, solid, pale species, not closely related to any form I have seen. The several palatal plicæ stand upon a low callous ridge. There is a good deal of variation in size.

#### Section TYRANNOPHÆDUSA Pils.

##### *Clausilia aurantiaca sakui* n. subsp. Pl. LV, fig. 52.

Shell similar in form to *C. aurantiaca*, but *quite thin*, finely, distinctly and sharply striate, pale brownish-yellow; whorls 9 to 10. *Superior lamella separated from the spiral*; subcolumellar lamella emerging; clausilium with the upper and lower palatal plicæ imperfectly I-shaped (Pl. LV, fig. 52), latero-ventral. Clausilium similar to that of *C. aurantiaca*, but more delicate.

Length 13, diam. 3 mm.

Ruijin (Akizu), Kii. Types No. 86,473, A. N. S. P., from No. 1,046 of Mr. Hirase's collection.

This form is also somewhat similar to *C. caryostoma* and *C. c. jayi*, both of which have the closing armature subventral; but the clausilium differs, and the palatal plicæ are shorter in *C. a. sakui*.

#### Section NESIOPHÆDUSA nov.

##### Group of *C. ptychochila* Pils., Proc. A. N. S. Phila., 1901, p. 418.

Phædusoid Clausiliæ of normal contour, with a tendency to weak interlamellar plication. Inferior lamella prominent in the mouth, *spirally ascending*, thick, sometimes indistinctly doubled within; palatal armature lateral, the lunella arising from the middle of a strong lower palatal plica, and curving inward above in a short upper palatal plica. Clausilium very convex on the palatal side, tapering distally to a blunt, thickened apex, channeled on the outer face. Type *C. bernardii* Pfr.

I formerly included the species of this section in *Hemiphædusa*, from which they differ totally in the form of the clausilium, and in the spirally ascending inferior lamella. *C. excellens*, of which the clausilium and palatal armature are unknown, will probably be found to belong to *Luchuphædusa*. The other species are closely related.

***Clausilia okinoerabuensis* n. sp.** Pl. LII, figs. 13, 14.

Shell subcylindric below, the upper half tapering and somewhat attenuate; pale uniform yellowish-corneous. Surface glossy, finely, strongly striate, the striation coarser on the back of the last whorl. Whorls 10, the upper 3 smooth. Aperture ovate-piriform, the peristome reflexed and thickened, with a small notch on the right side of the superior lamella, and very indistinct traces of crenulation near it. Superior lamella marginal, small, subvertical, continuous with the spiral lamella which penetrates to the left side. Inferior lamella forming a rather prominent fold in the aperture, calloused and spirally ascending within, shorter than the spiral lamella. Subcolumellar lamella emerging to the lip-edge. Principal plica short, dorsal and lateral. Lunella strong, oblique, arising from the middle of a strong lower palatal plica, and bending inward above in a rather long upper palatal plica.

Length 22 to 23, diam. 5 mm.

Clausilium (Pl. LIII, figs. 23, 24) well curved, the columellar margin straight, slightly excised at the filament, the palatal margin very convex, then tapering and concave toward the apex, which is blunt and thickened.

Okinoerabushima, Ōsumi. Types No. 87,611, A. N. S. P., from No. 1,251 of Mr. Hirasc's collection.

A smaller species than *C. crenilabium*, with the upper palatal plica better developed, with scarcely any interlamellar plication of the upper lip, and a callous but not internally double inferior lamella. The clausilium is less deeply channeled distally. It is not so coarsely sculptured as *C. bernardii*, and is more slender than *C. ptychochila*.

Fossil specimens from a deposit of calcareous sand on the shore of Okinoerabushima are similar to the living specimens in structure, but some specimens are shorter:

Length 23.6, diam. 5 mm.

Length 21, diam. 5.4 mm.

Section LUCHUPHÆDUSA Pils.

***Clausilia azumai* n. sp.** Pl. LII, figs. 6, 7.

Shell solid and strong, cylindric below, the upper half regularly taper-

ing, slightly attenuated above. Pale yellow. Whorls  $11\frac{1}{2}$ , convex, finely striate, the last whorl becoming coarsely striate behind. Aperture broadly piriform, white. Peristome with the outer and basal margins well reflexed and thickened within; columellar and parietal margins beautifully crenulate. Superior lamella marginal, compressed, continuous with the spiral lamella, which penetrates past the aperture to the left side. Inferior lamella forming a rather small, subhorizontal fold in the aperture, with an accessory fold below it extending to the margin; as long inside as the spiral lamella. Subcolumellar lamella emerging to the lip-edge, decidedly shorter inside than the other lamella. The principal plica is long, visible in the throat, extending across the ventral side. The upper palatal plica is very oblique. Lower palatal plica long and angularly bent, a very oblique and rather long lunella arising from the angle. It lies in a subventral position.

Length 25.3, diam. 6 mm.

Clausilium rather broad, truncated distally, with a wide and rather long, thick apical projection on the columellar side, and a slight projection on the outer side of the end; the palatal margin rounded.

Shimo-Koshikijima, Satsuma. Type No. 87,603, A. N. S. P., from No. 1,237 of Mr. Hirase's collection.

This fine species is related to *C. callistochila*, from which it differs in the following peculiarities: The striation is finer; the inferior lamella is more distinctly doubled below; the lunella is longer and more ventral in position, and the clausilium has a larger process at the apex. It is also related to *C. una* Pils., of Gotō, Hizen; but in that species the lunella is shorter and lateral, and the clausilium is much less specialized, being much like that of *Stereophædusa*.

*C. azumai* is one of the finest species collected this year by Mr. Azuma in the islands of Satsuma.

*Clausilia una*, which I formerly placed in *Stereophædusa*, should probably be transferred to *Luchuphædusa* or to a separate and special section allied to *Luchuphædusa*, characterized by the unspecialized clausilium, while all other structures are *Luchuphædusoid*.

*C. azumai idiopylis* n. subsp. Pl. LII, fig. 8.

Somewhat smaller than *C. azumai* and dull reddish-brown; inner lip less strongly crenate; inferior lamella thickened but not distinctly doubled below; subcolumellar lamella immersed. Clausilium (Pl. LIII, fig. 17) more oblique and more distinctly notched distally.

Length 22, diam. 5.3 mm.; whorls  $11\frac{1}{2}$ .

This form, sent with *azumai*, may prove to be included in the range of variation of that species, but in the absence of interme-

diate specimens it seems best to call attention to its differential features.

*Clausilia nakadai* n. sp. Pl. LII, figs. 9, 10, 11.

Shell fusiform, moderately attenuate above; yellow, the worn early whorls whitish, nearly lusterless, finely striate. Whorls 10, convex, the latter half of the last flattened. Aperture piriform, white within, with distinct, slightly retracted sinulus. Peristome broadly reflexed, with a fold or doubling behind, thickened within. *Columellar and parietal margins crenulated*. The superior lamella is compressed, vertical and marginal, and continuous with the spiral lamella, which is very high, and penetrates past the ventral side to the middle of the left side. The inferior lamella projects as a very strong columellar fold in the aperture, and penetrates inward slightly farther than the spiral lamella. The subcolumellar lamella emerges to the lip-edge, and penetrates as deeply as the spiral lamella. *The principal plica extends nearly to the lip*, and enters deeply. There is a rather long, oblique upper palatal plica, and an obliquely ascending and entering lunella arising from the summit of a long, angularly bent lower palatal plica; all lying in a nearly ventral position. The lower end of the lower palatal plica is visible in the aperture in an oblique view.

Length 20.5, diam. 5 mm.

Length 18.5, diam. 4.8 mm.

*Clausilium* (Pl. LIII, figs. 18, 19) strongly curved spirally, the columellar side of the apex projecting in a thick blunt process, the palatal side rounded, a wide shallow notch in the middle. Proximally it tapers gradually and without excision into the filament.

Matsubara, Tokunoshima. Types No. 87,594, A. N. S. P., from No. 1,205a of Mr. Hirase's collection.

*C. nakadai* is intermediate between *C. callistochila* and *C. oshimæ* in size, geographic position and morphology. The aperture resembles that of *oshimæ* in shape, but is wider, and the right lip is more crenulated. The lamellæ are not quite so long as in *oshimæ*. The lunella is better developed than in either of the other species, and the lower palatal plica is far shorter than in *C. oshimæ*, but differs from that of *callistochila* in shape.

This handsome *Luchuphædusa* is named in honor of Mr. Nakada, who has brought to light more Riukian land snails than all other collectors combined.

*C. nakadai degenerata* n. subsp. Pl. LII, fig. 12.

Fresh specimens are pale corneous-buff, very glossy, and typically more slender than *nakadai*, with the aperture a little narrower and

more projecting, the right lip less reflexed, thin, irregularly and more or less *obsoletely crenulate*. In internal structure it agrees with *nakadai*. The clausilium (Pl. LIII, fig. 22) is more deeply notched distally than in *C. nakadai*.

Length 24, diam. 4.6 mm.; whorls  $11\frac{1}{2}$ .

Length 21, diam. 4.5 mm.; whorls  $10\frac{1}{2}$ .

From Sanmura and Matsubara specimens were sent (No. 1,205) agreeing with Nakada's *Clausilia* in internal structure, but with the right lip thin and crenulate only at the edge. Some are glossy and slender, others somewhat stouter and decorticated throughout.

***Clausilia tokunoshimana* n. sp. Pl. LII, figs. 4, 5.**

Shell cylindric below, the upper half rapidly tapering, solid, very pale brownish-yellow. Surface glossy when unworn, costulate, more coarsely so on the back of the last whorl. Whorls  $10\frac{1}{2}$ , moderately convex, the last half of the lower whorl contracted. Aperture trapezoidal-ovate, white, the outer margin of the peristome well reflexed and thickened within; columellar and parietal margins narrower, closely and finely crenulate (the crenulation sometimes subobsolete). Superior lamella marginal, rather small, continuous with the spiral lamella, which penetrates to the middle of the left side. Inferior lamella forming a prominent columellar fold, more or less distinctly doubled below, penetrating inward as deeply as the spiral lamella. Subcolumellar lamella emerging to the lip-edge, ascending within nearly as far as the other lamellæ. The principal plica is rather *short, latero-ventral, not visible in the aperture*. Upper palatal plica small, oblique. Lower palatal plica long and bent; the long and very oblique, ventral lunella arising from it in the middle. The lower palatal plica is not visible in the aperture.

Length 17, diam. 4.2 mm.

Length 16, diam. 4 mm.

The clausilium (Pl. LIII, figs. 20, 21) is very broad distally, and has a long projection on the columellar side; the palatal side is broadly rounded. It is not excised at the filament.

Tokunoshima, Ōsumi, the types from Sanmura, No. 87,586, A. N. S. P., from No. 1,200 of Mr. Hirase's collection. Other similar specimens were sent from Teteyama, near Sanmura (No. 1,200a).

This species is allied to *C. mima* of Ōshima, but differs in being larger and very coarsely sculptured; the lunella is nearly ventral, and there is a whorl or two more. The clausilium is similar in the two species.

## Section OOPHÆDUSA nov.

The clausilium is well curved, spatulate, with *a thick rib near the columellar side of the distal half, continued and projecting finger-like at the apex*; proximally it tapers into the filament, and is not emarginate.

The shell is short, oblong, *of few whorls* (6-6½ in the species known), the *summit very obtuse*, entire. Superior continuous with the spiral lamella. Inferior lamella strongly spiral within, bifid below. Upper and lower palatal plicæ long, the latter united with an oblique lunella.

The only species now known has a crenulate lip, like *Luchuphædusa*, and the palatal armature and clausilium are similar in the two groups; but in *Luchuphædusa* the shell is shaped like ordinary *Clausiliæ*, while in *Oophædusa* the thick-set shell is not in the least attenuate above, being shaped like a snake's egg, and there are but few whorls.

*Clausilia ophidoon* n. sp. Pl. LII, figs. 1, 2, 3.

Shell oblong, fusiform with blunt ends, the penultimate whorl widest; moderately strong; brown; finely striate throughout except the first whorl, which is whitish and smooth; somewhat shining. Whorls 6½, the first rather large, not projecting, forming a large, *very obtuse apex*; last whorl tapering. Aperture slightly oblique, piriform, the peristome white, reflexed, thickened within, the *columellar and parietal margins closely and strongly folded*, the edge crenulate. Superior lamella thin and high, marginal, continuous with the spiral lamella, which penetrates past the aperture to the left side. Inferior lamella emerging to the lip-edge, spirally ascending within, and penetrating about as far as the superior lamella; below it branches off in a columellar lamella which also emerges to the lip-edge. Subcolumellar lamella emerging. Principal plica extending from the middle of the dorsal side to a point above the sinulus, visible through from the outside. Upper palatal plica latero-ventral, long, converging inward toward the principal plica. Lower palatal plica very long and very oblique, united with a very oblique lunella, nearly parallel with the plica.

Length 14.4, diam. 5 mm.

Length 13, diam. 4.5 mm.

*Clausilium* (Pl. LIII, figs. 15, 16) strongly curved, spatulate, the palatal margin strongly arcuate. A callous rib arises about midway of the columellar margin, and projects in a finger-like process at the apex.

Shimo-Koshikijima, Satsuma. Types No. 87,602, A. N. S. P., from No. 1,235 of Mr. Hirase's collection.

This remarkable species has no near allies among known *Clausiliæ*.

One specimen sent with the type lot is smaller, length 11.7, diam. 4 mm., with 6 whorls, pale yellowish in color, and the inferior lamella proper, while visible in the throat, does not extend to the lip (Pl. LII, fig. 3).

Section STEREOPHÆDUSA Bttg.

*Clausilia subhickonis* n. sp. Pl. LIV, figs. 34, 35, 36, 37, 38.

Shell fusiform, attenuate above, but terminating in a rather large apex, solid, light yellow, rather strongly rib-striate. Whorls 12 to 12½, convex, the first 3 or 4 cylindric, the penultimate whorl swollen as seen dorsally, last whorl flattened, convex below, not noticeably different in sculpture. Aperture ovate, subvertical, the peristome white, reflexed and thickened within, continuous in a slightly raised ledge across the parietal wall, a little sinuous or notched at the position of the superior lamella. Superior lamella decidedly oblique, marginal, continuous within with the spiral lamella, which penetrates inward to the middle of the ventral side. Inferior lamella appearing in front as a strong, subhorizontal fold crossing a much more oblique callous columellar fold which continues weakly upon the lip; the whole appearing as two nodules. Within the back the inferior lamella is strongly spiral but not very high. It penetrates inward more deeply than the superior lamella. The subcolumellar lamella emerges to the lip-edge. The principal plica is very short and lateral. Palatal plicæ 4, strong, somewhat oblique and parallel, the lower one a little arcuate, the two intermediate plicæ shorter than the others.

Length 21 to 22.5, diam. 5 mm.

The clausilium (Pl. LIV, figs. 34, 35) is narrower than usual in *Stereophædusa*; the columellar margin is straight, a little excised near the filament; the palatal margin convex, contracting distally; the distal end is compressed and ridged inside, and the apex is rounded and noticeably thickened.

Isobe, Shima. Types No. 86,499, A. N. S. P., from No. 1,168 of Mr. Hirase's collection.

This *Stereophædusa* is related to *Cl. hickonis* Kobelt, but *hickonis* is more attenuate above, has more whorls, which are less convex, finer sculpture, longer upper and lower palatal plicæ, the latter more curved, and the superior lamella in *C. hickonis* is usually separated from the spiral lamella, or at least much lower at their junction.

*C. subhickonis* has been taken also at Gokasho-mura, Ise, a place not very far from the type locality. The columella is not quite so conspicuously binodose in these specimens, two of which measure—

Length 24, diam. 5.5 mm.

Length 23.5, diam. 5 mm.

Like most of the larger *Clausiliæ*, it is sometimes overgrown with green algae, and the original surface destroyed.

***Clausilia hickonis saucia* n. subsp.**

Shell fusiform, solid, brown. Surface glossy, rather coarsely striate, the striae nearly as wide as the intervals. Penultimate whorl widest, the spire regularly tapering, *summit broadly truncate*. Whorls remaining about  $8\frac{1}{2}$  (several whitish empty ones sometimes persisting above the apical plug), moderately convex, the last tapering downward. Aperture vertical, piriform, brown within. Peristome white, continuous, reflexed, and thickened within; the parietal margin short, straightened, barely free. Superior lamella marginal, high and compressed, very oblique, continuous with the spiral lamella, which penetrates past the middle of the ventral side. Inferior lamella strong, approaching the superior, appearing below like a strong lamella crossing an oblique, callous columellar fold; extending inward as far as or further than the spiral lamella. Subcolumellar lamella more or less emerging, but not reaching the lip-edge. Principal plica short, lateral. Upper palatal plica rather long, obliquely converging inward to the principal plica. Lower palatal plica nearly as long, strong, somewhat arcuate, parallel to the upper; a shorter plica midway between them.

Length 26.3, diam. 6.4 mm.

Length 27, diam. 6.5 mm.

*Clausilium* rather long and nearly parallel-sided, well curved, obtuse and noticeably thickened apically, a little excised on the palatal side of the apex, the rest of the palatal margin being arcuate. Both margins regularly taper to the filament.

Sodayama, Tosa. Types No. 84,784, A. N. S. P., from No. 1,023 of Mr. Hirase's collection.

The broadly truncate summit and robust stature distinguish this from *C. hickonis*. *C. fultoni* Sykes, which is merely a weakly characterized variety of *C. vasta* Bttg., differs by its more straightly ascending inferior lamella as well as by the entire apex.

ZAPTYCHOID PHYLUM.

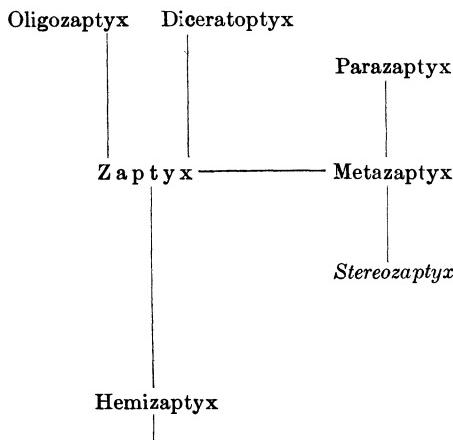
The material brought together by Mr. Hirase's collector in the islands of the Ryukyu curve this year, enlarge our knowledge of this phylum to such a degree that a revision of the group is required.

The entire series of Zaptychoid *Clausiliæ* consists of small, often

very small, species, few-whorled, with a clausilium very deeply excised on the columellar side of the filament, and abruptly bent and twisted there. The closing apparatus is always lateral or dorso-lateral, the lamellæ rarely penetrate as far as the middle of the ventral side, and the spiral lamella is usually low.

The sections *Oligozaptyx* and *Diceratoptyx* constitute two new secondary phyla, independently evolved from the typical group. In both the clausilium is notched, and the whole structure shows great specialization. Another line of differentiation is represented by the sections *Metazaptyx* and *Parazaptyx*, in which the inferior lamella has become spiral, thereby obstructing the throat, and the clausilium is strongly curved. In *Parazaptyx* the clausilium is further modified in a peculiar and unexampled manner. Then we come to a series of groups in which the shell is without accessory plicæ and lamellæ, and now defined as *Hemizaptyx* and *Stereozaptyx*. The species of these groups I had formerly appended to various sectional divisions as aberrant forms. The evidence now at hand indicates that they are either degenerate or primitive branches of the *Zaptyx* phylum. *Stereozaptyx* may well be a secondarily simplified form of *Parazaptyx*, in which the accessory plicæ and lamellæ have been obliterated in the general and extreme thickening of the shell walls. If so, immature shells might possibly still show some trace of them.

The interrelations of the subordinate groups and their approximate phylogeny, so far as I understand the recent and fossil forms now known, may be represented by the following diagram. The names of those groups of which the position is hypothetical are in *italics*.



A key to the sections follows:

I.—Lunella oblique, straight, becoming more or less incurved below; above united with or contiguous to a short or moderate upper palatal plica, somewhat in the shape of the letter J (except in a few forms where the upper palatal plica is absent).

*a.*—Inferior lamella receding, obliquely ascending and straightened within the last whorl; clausilium parallel-sided, rounded or acuminate distally, usually rather straight except near the filament.

*b.*—Shell without sutural plicæ, fulcrum or parallel lamella,  
Section *Hemizaptyx*.

*b<sup>1</sup>.*—Shell thin; sutural plicæ, fulcrum and parallel lamella developed, . . . . . Section *Zaptyx*.

*a<sup>1</sup>.*—Inferior lamella spirally ascending within the last whorl, usually projecting into the aperture; clausilium strongly curved.

*b.*—Clausilium tapering distally to an acuminate apex; shell solid and strong, without sutural plicæ or accessory lamellæ within; no upper palatal plica,  
Section *Stereozaptyx*.

*b<sup>1</sup>.*—Clausilium wide, the apex obtuse; shell thin, the inferior lamella approaching the superior as a thin fold in the aperture.

*c.*—Clausilium smooth on the outer (convex) face; sutural plicæ present, . . . Section *Metazaptyx*.

*c<sup>1</sup>.*—Clausilium buttressed on the outer face by an erect, transverse plate; shell without sutural plicæ,  
Section *Parazaptyx*.

II.—The lunella arises from the middle of a long, arched lower palatal plica, and curves inward at its upper end; no superior lamella; sutural plicæ, fulcrum and parallel lamella developed. Clausilium short, deeply notched on the palatal side near the apex,  
Section *Oligozaptyx*.

III.—The upper palatal plica is very long, an extremely short lunella branching from near its inner end; superior lamella and sutural plicæ developed. Clausilium notched on the palatal side near the apex, . . . . . Section *Diceratoptyx*.

These groups are new with the exception of *Zaptyx*. They are reviewed below except *Stereozaptyx* (=group of *C. entospira*, *Proc. Acad. Nat. Sci. Phila.*, 1901, p. 644), type *C. entospira* Pils. No other species of *Stereozaptyx* is known.

#### Section HEMIZAPTYX nov.

A group of small species differing from *Zaptyx* in lacking sutural plicæ and accessory lamellæ, and often in the texture of the shells. They are all small, mostly under 11 mm. long. Most of those known

are from Tanega-shima and Yaku-shima, but the group extends south to Tokuno-shima. Type *C. pinto*.

The following species belong here:

- C. pinto* Pils. Tanega-shima, Ōsumi.
- C. ptychocyma* Pils. Tanega-shima, Ōsumi.
- C. ptychocyma yakushimæ* Pils. Yakushima, Ōsumi.
- C. asperata* Pils. Shimo-Koshikijima, Satsuma.
- C. caloptyx* Pils. Yakushima, Ōsumi.
- C. agna* Pils. Yakushima, Ōsumi.
- C. purissima* Pils. Miyakejima, Izu.
- C. hyperaptyx* Pils. Tokunoshima, Ōsumi.
- C. munus* Pils. Ōshima, Ōsumi.

*Key to Species of Hemizaptyx.*

I.—Clausilium rounded at the distal end.

- a.—Upper palatal plica extremely short or apparently absent, merely an enlargement of the upper end of the lunella.
  - b.—Solid and strong, nearly smooth; lip very thick, hardly free above; superior lamella contiguous to the spiral; subcolumellar lamella emerging. Tanegashima,  
*C. pinto*.
  - b<sup>1</sup>.—Extremely solid and strong; almost smooth, the last whorl coarsely wrinkled behind the lip; superior lamella separated from spiral; subcolumellar lamella emerging or immersed. Tanegashima and Yakushima,  
*C. ptychocyma*.
  - b<sup>2</sup>.—Moderately strong; very finely striate, the last whorl with spaced riblets behind; superior lamella continuous with the spiral; subcolumellar lamella immersed. Shimo-Koshikijima, Satsuma, . . . . . *C. asperata*.
- a<sup>1</sup>.—Upper palatal plica short but distinctly developed.
  - b.—Solid and strong; surface sculptured with strong straight ribs; length 7 to 8 mm. Yakushima, . . *C. caloptyx*.
  - b<sup>1</sup>.—Surface smooth, brilliantly glossy; more or less transparent.
    - c.—Whorls  $6\frac{3}{4}$  to 8; shell stoutly fusiform, the diameter contained  $3\frac{1}{2}$  to 4 times in the length; subcolumellar lamella weakly emerging. Yakujima, . . *C. agna*.
    - c<sup>1</sup>.—Whorls 10; shell slenderly fusiform, the diameter contained 5 times in the length; subcolumellar lamella immersed. Miyakejima, Izu, . . *C. purissima*.
- II.—Clausilium angular or acuminate at the distal end; superior lamella continuous with the spiral; upper palatal plica rather short, scarcely connected with the slightly curved lunella.
  - a.—Shell dark, glossy and rather thin, 10 to 11 mm. long; about  $7\frac{1}{2}$  whorls; sides of the clausilium strongly reflexed. Tokunoshima, . . . . . *C. hyperaptyx*.

*a<sup>1</sup>.*—Shell brown, 13 to 15 mm. long; about 9 to 10 whorls. Distal half of the clausilium flat. Oshima, . . . . *C. munus.*

***Clausilia purissima* n. sp.** Pl. LV, figs. 47, 48, 49.

Shell slenderly fusiform, rather thin, *transparent*, with a greenish tint, the surface polished, with a brilliant gloss, faintly marked with slight growth-wrinkles. Spire regularly tapering to the obtuse apex, the lateral outlines nearly straight. Whorls 10, convex, parted by a well-marked suture, the last whorl a little compressed laterally. Aperture oval, the peristome slightly expanded, a little thickened, continuous, the parietal margin barely free, short and straightened. Superior lamella marginal, rather high and thin, oblique, continuous with the spiral lamella, which penetrates about to the middle of the ventral side. Inferior lamella hardly visible in a front view, receding, straightly ascending, shorter within than the superior lamella. Subcolumellar lamella very deeply immersed, penetrating inward about as far as the inferior lamella. Principal plica short, dorso-lateral, visible in the throat, penetrating slightly past a lateral position. Upper palatal plica short, dorso-lateral. Lunella oblique, straight, strongly curving inward at the lower end, not quite reaching the upper palatal plica.

Length 12.3 to 12.8, diam. 2.3 mm.

Clausilium (fig. 47) parallel-sided, the apex rounded; abruptly and deeply excised on the columellar side of the filament.

Miyakejima, Izu. Types No. 85,731, A. N. S. P., from No. 1,089 of Mr. Hirase's collection.

In this exquisite species the shell is so pellucid that the plicæ, lamellæ and axis may be seen through. It is not closely related to any known species, but seems to belong to a group characteristic of the islands south of Kyushu. It is with some doubt, however, that I place *C. purissima* in the group *Hemizaptyx*. It may belong to *Hemiphædusa*.

***Clausilia asperata* n. sp.** Pl. LV, figs. 42, 43, 44.

Shell fusiform, the spire noticeably attenuated above, moderately strong, grayish-brown; glossy; very finely striate, the back of the last whorl sculptured with narrow, widely spaced riblets. Whorls  $8\frac{1}{2}$  to  $9\frac{1}{2}$ , convex, the last tapering. Aperture ovate, the peristome thin, expanded and reflexed, shortly free and projecting above. Superior lamella small, marginal, continuous with the spiral lamella, which is rather high within, and penetrates nearly to the middle of the ventral side. Inferior lamella deeply receding, not visible from in front; inside it is nearly straight, thickened and quite high; penetrating a little less deeply than the spiral lamella. The subcolumellar lamella

is wholly immersed. Principal plica short. The upper palatal plica is extremely short, a mere enlargement of the summit of the narrow lunella, which is straight above, curved inward below.

Length 11.2, diam. 2.3 mm.; whorls  $9\frac{1}{2}$  (figs. 43, 44).

Length 9, diam. 2 mm.; whorls  $8\frac{1}{2}$  (fig. 42).

The clausilium is parallel-sided, nearly straight, rounded at the apex, excised on the columellar side of the filament. The palatal margin is recurved and dilated.

Shimo-Koshikijima, Satsuma. Types No. 87,606, A. N. S. P., from No. 1,242 of Mr. Hirase's collection.

This species is the only Zappyroid form yet known from the Koshikijima group. It is related to *C. pinto* from Tanegashima, but differs in the anteriorly projecting aperture, thinner lip, less solid shell, immersed subcolumellar lamella and the somewhat differently shaped clausilium. Moreover, the back of the last whorl is sculptured with spaced riblets, while the rest of the shell has very close, delicate striae, becoming imperceptible above the middle of the shell. The largest specimen (figs. 43, 44) is extensively worn, and therefore figured in outline. The sculpture is well shown in fig. 42.

*Clausilia hyperptyx* n. sp. Pl. LVI, figs. 85, 86, 87, 88.

The shell is fusiform, glossy, dark reddish-brown, weakly, finely striate, the back of the last whorl densely and sharply striate. Upper half of the spire rapidly tapering to a rather acute apex. Whorls  $7\frac{1}{2}$ . Aperture like that of *C. hyperptyx*, but the peristome is somewhat more widely expanded. *Superior lamella continuous with the spiral lamella*, which penetrates to the middle of the ventral side, and is much dilated within. There is no fulcrum or parallel lamella. The inferior lamella recedes deeply, is high, strong and nearly straight within the last whorl, and penetrates nearly as deeply as the spiral lamella. The subcolumellar lamella emerges. The principal plica is a half whorl long, dorsal and lateral. The upper palatal plica is short, and lies mainly inward from the upper end of the lunella, with which it is scarcely connected. The lunella is slightly arcuate. There are no sutural plicæ.

Length 10.9, diam. 2.3 mm.

Length 10, diam. 2 mm.

Clausilium (Pl. LVI, figs. 85, 87, 88) rather long, parallel-sided, the two sides very strongly recurved (see fig. 85), the columellar side is narrowly thickened; the distal end is somewhat acuminate.

Tokunoshima, Ōsumi. Types No. 87,597, A. N. S. P., from No. 1,230 of Mr. Hirase's collection.

This species closely resembles *C. hyperoptyx* in color and sculpture, but is somewhat more obese, with more acute apex, and it is quite different in internal structure and in the shape of the clausilium. It is not closely related to any other species now known.

The clausilium resembles that of *C. munus* in shape, except that in *munus* it is flat, not rolled back on the two sides.

Section ZAPTYX Pilsbry, *s.str.*

Proc. A. N. S. Phila., 1900, p. 672.

To the definition of this group may be added: Inferior lamella but slightly curved and obliquely ascending within the last whorl; superior and spiral lamellæ sometimes continuous; end of the clausilium rounded.

The following species belong to this group:

*C. hirasei* Pils. Kagoshima and Sakura Island, Satsuma.

*C. kikaiensis* Pils. Kikaiga-shima, of the Ōshima group.

*C. sarissa* Pils. Okinoerabu-shima, of the Ōshima group.

*C. hyperoptyx* Pils. Ryukyu.

*C. hyperoptyx yoronjimana* Pils. Yoronjima.

*C. yaeyamensis* Pils. Yaeyama.

It is likely that *C. strictaluna* Bttg., of Kyushu, a species I have not seen, will prove to belong to *Zaptyx*; but the clausilium is still unknown.

*Clausilia hirasei* Pils. Pl. LVI, figs. 64, 65, 66, 67.

Acad. Nat. Sci. Phila., 1900, pp. 446, 673.

The original figure was in outline, and new ones are now given for comparison with the other species herein described.

The clausilium (figs. 66, 67) is more dilated on the palatal side of the filament than in *C. hyperoptyx*, *C. sarissa*, or other related species.

The types were from Kagoshima, Satsuma. The specimens now illustrated are from Sakura Island, in Kagoshima Bay. It is not known from any other localities.

*Clausilia kikaiensis* n. sp. Pl. LVI, figs. 68, 69, 70, 71.

*C. hirasei*, a more slender form, etc., from Kikai, Pilsbry, Proc. A. N. S. Phila., 1901, p. 465.

*C. hirasei* var. *kikaiensis* Pils., Proc. A. N. S. Phila., 1901, p. 651 (no description).

Shell small, slender, fusiform, tapering from the penultimate whorl to the small but obtuse apex, near which it is slightly attenuated. Chestnut-brown of varying shades, the last whorl often darker. Surface glossy, faintly striate, nearly smooth, the back of the last whorl striate, the striae usually widely spaced. Whorls about 8. Aperture

piriform, the peristome very narrowly reflexed, whitish. Superior lamella small and low, widely separated from the low short spiral lamella. Inferior lamella receding, not visible in a front view; low and obliquely ascending within. Subcolumellar lamella emerging, very slender, rising angularly on the palatal wall below the lunella. A short fulcrum and parallel lamella are present. Principal plica dorsal and lateral, visible in the aperture. Upper palatal plica extremely short, weakly connected with the lunella, which is straight above, but curves inward slightly at the lower end. There are three short sutural plicæ, the middle one often inconspicuous.

Length 9, diam. 2.1 mm.

Length 7.2, diam. 1.7 to 2 mm.

*Clausilium* (Pl. LVI, figs. 68, 69) rather long, parallel-sided, rounded at the apex, deeply excised at the columellar side of the filament.

Kikaiga-shima. Ōsumi. Types Nos. 79,728 and 80,787, A. N. S. P., from Nos. 557 and 557b of Mr. Hirase's collection. It has also been found by Mr. Nakada at Tokuno-shima, Ōsumi (No. 1,203 of Mr. Hirase's collection). It will probably turn up on the intermediate islands of the Ōshima subgroup.

This species is closely related to *C. hyperoptyx* of Ryukyu (Okinawa), but it differs in the less swollen embryonic whorls, shorter upper palatal plica, less developed superior lamella and usually smaller size, though the largest specimens of *kikaiensis* are equal to *hyperoptyx*. *C. hirasei*, from Satsuma, along Kagoshima Bay, is a decidedly wider shell, with less attenuated spire. The clausilium in *C. kikaiensis* resembles that of *C. hirasei* and *C. sarissa*, but it is decidedly less dilated on the palatal side of the filament than in *C. hirasei*.

I formerly considered the Kikai specimens to be a variety of *C. hirasei* (these *Proceedings* for 1901, p. 465), but further study of much larger series of both forms shows that their differential features are constant. They are rather widely separated geographically.

***Clausilia sarissa* n. sp. Pl. LVI, figs. 72, 73, 74, 75.**

Shell cylindric below, tapering and a little attenuated above; brown, the fully adult shells marked with whitish or creamy lines and streaks. Surface somewhat glossy, very faintly striatulate, nearly smooth, the last third of the last whorl sharply, finely striate. Whorls 8, quite convex. Aperture ovate, the peristome narrow, reflexed, and in fully adult shells somewhat thickened at the edge. Superior lamella small, vertical, not continuous with the low small spiral lamella. Inferior lamella receding, visible only in an oblique view in the aperture, high

and a little curved within, not continued parallel to the spiral lamella, but a very small inserted lamella (*l. inserta*) appears near the end of the spiral lamella. *Subcolumellar lamella wholly immersed.* There is a fulerum and a parallel lamella. Principal plica short, dorsal and lateral, visible in the mouth. Upper palatal plica short, joined in the middle to the long lunella, which is straight above, curved inward below. A single sutural plica is developed, with the trace of a second upper one.

Length 10, diam. 2.2 mm.

Length 9, diam. 2.3 mm.

Clausilium (Pl. LVI, figs. 72, 73) parallel-sided, rounded at the apex, deeply excised on the columellar side of the filament.

Okinoerabushima, Ōsumi. Types No. 87,613, A. N. S. P., from No. 1,253 of Mr. Hirase's collection.

This species resembles *C. hirasei*, but differs in the decidedly stronger striation of the last whorl behind the lip, the wider peristome, immersed subcolumellar lamella, the more convex whorls and the poorer development of sutural plicæ. It is nearly opaque. As in *C. hirasei*, the inferior lamella is interrupted within. The palatal side of the filament is less dilated above than in *C. hirasei*. The specimen figured has a thicker peristome than most of those sent. The figure is too distinctly streaked.

***Clausilia hyperoptyx* Pilsbry. Pl. LVI, figs. 76, 77, 78, 79.**

Proc. Acad. Nat. Sci. Phila., 1900, pp. 446, 472; 1901, pp. 423.

The statement in the original description that the "upper palatal plica is very short" was an error, which the figure (Pl. 14, fig. 12) corrects. The upper palatal plica is rather long, united in the middle with the lunella. The superior lamella is higher, better developed than in *C. hirasei* and *C. kikaiensis*. The tapering spire is distinctly attenuated above, but the apex is larger than in the related species; and the striation is better developed than in *C. hirasei* or *C. kikaiensis*. It is known only from Great Ryukyu Island (Okinawa); the specimens reported from Yaeyama prove to be specifically different.

Length 9 to 10, diam. 2 mm.

The clausilium (Pl. LVI, figs. 76, 77) is rather wide, rounded distally. It is wider than that of *hirasei*, *kikaiensis* or *sarissa*.

***Clausilia hyperoptyx yoronjimana* n. subsp.**

The superior and spiral lamellæ are more or less completely disconnected; and the lunella joins the middle of the short upper palatal plica, as in *C. hyperoptyx*; but the shell is perceptibly wider, and the last

whorl is decidedly less striate. It is also paler and somewhat more transparent.

Length 10 to 10.5, diam. 2.4 mm.

Yoronjima, Ōsumi. Types No. 88,767, A. N. S. P., from No. 1,253a of Mr. Hirase's collection.

**Clausilia yaeyamensis n. sp.** Pl. LVI, figs. 80, 81, 82, 83, 84.

Shell cylindric below, regularly tapering from the penultimate whorl to the apex; dark chestnut, paler near the apex. Surface glossy, evenly, finely and sharply striate, the back of the last whorl a little more irregularly so. Whorls  $8\frac{1}{2}$ , the earlier ones quite convex, the later much less so. Aperture piriform, the peristome expanded, whitish. Superior lamella rather high, compressed, weakly continuous with the spiral lamella, which penetrates nearly to the middle of the ventral side. Inferior lamella deeply receding, nearly straight and obliquely ascending within, shorter than the spiral lamella. Subcolumellar lamella emerging. A parallel lamella and fulcrum present. Principal plica about one-half a whorl long, dorsal and lateral, visible in the aperture. Upper palatal plica very short, connected with the straight lunella, which bends inward at its lower end. There are two sutural plicæ.

Length 11, diam. 2.3 mm.

Length 10.5, diam. 2.3 mm.

Clausilium (Pl. LVI, figs. 80, 81, 82) wider above than below, obtusely rounded distally, abruptly excised at the filament.

Yaeyama, Ryukyu. Types No. 80,963 and 87,561, A. N. S. P., from No. 457b of Mr. Hirase's collection.

This species is related to *C. hyperoptyx*, from which it differs in the even striation and very short upper palatal plica, and the weakly continuous superior and spiral lamellæ. The clausilium closely resembles that of *C. hyperoptyx*. I reported this species under the name *hyperoptyx* in these *Proceedings* for 1901, p. 651, not having at that time opened the specimens. *C. hyperoptyx* has not been found on Yaeyama, and probably does not occur in the southwestern group of islands.

Section METAZAPTYX nov.

Similar to *Zaptyx*, except that the inferior lamella ascends spirally within and in the mouth is visible as a fold approaching the superior lamella; the base of the shell is somewhat sack-like. The clausilium is broad, strongly curved distally, shorter than that of *Zaptyx*, and rounded at the apex.

The few species now known of this group are scattered over a wide expanse:

- C. hachijoensis* Pils. Hachijo-jima, Izu group.  
*C. dæmonorum* Pils. Kikaiga-shima, Ōshima group.  
*C. dæmonorum viva* Pils. Tokuno-shima, Ōshima group.  
*C. pattalus* Pils. Tarama-jima, Ōshima group.  
*C. pattalus miyakoensis* Pils. Miyaka-jima, Ōshima group.

***Clausilia pattalus* n. sp.** Pl. LVII, figs. 93, 94, 95, 96, 97.

Shell cylindric below, tapering from the penultimate whorl in a long, somewhat attenuate spire; brown, becoming whitish at the apex. Surface glossy, finely and rather weakly striate, becoming finely and sharply striate on the last third of the last whorl. Whorls  $8\frac{1}{2}$  to 9, convex, the second disproportionately long, the last compressed laterally, very convex beneath. Aperture irregularly ovate, the peristome whitish, reflexed, somewhat thickened within. Superior lamella small marginal, continuous with the low spiral lamella, which penetrates to a point above the columellar lip. Inferior lamella deeply receding, scarcely visible in a front view, but seen in an oblique view as a small fold approaching the superior lamella; within it ascends spirally, and penetrates as far as the spiral lamella. *The subcolumellar lamella is immersed.* Fulerum and parallel lamella are developed. Principal plica about one-third of a whorl long. Upper palatal plica rather long, connected in the middle with the lunella, which curves inward below. There are two sutural plicæ, the upper one weak or indistinct.

Length 11.2, diam. 2.5 mm.; whorls 9.

Length 10, diam. 2.3 mm.; whorls  $8\frac{1}{2}$ .

*Clausilium* (Pl. LVII, figs. 93, 94, 95) rather short, parallel-sided, the distal end very strongly curved; the apex is blunt, tapering a little on both sides. It is somewhat thickened along the palatal side, and is very abruptly and deeply excised near the filament.

Taramajima, one of the Miyako subgroup of the Southwestern group.

Types No. 87,639, A. N. S. P., from No. 1,301a of Mr. Hirase's collection.

This species is stronger than *C. dæmonorum viva*, from which it differs in the immersed subcolumellar lamella, the less dilated, more immersed inferior lamella, and the better development of the peristome and internal lamellæ. There are also differences in the shape of the clausilium.

***C. pattalus miyakoensis* n. subsp.**

Shell thinner, paler, and often smaller than *C. pattalus*, with the superior lamella smaller. All of the lamellæ and plicæ are weaker.

Length 10.3, diam. 2.3 mm.; whorls 9.

Length 9, diam. 2 mm.; whorls 8.

Miyakojima. Types No. 87,638, A. N. S. P., from No. 1,301 of Mr. Hirase's collection.

As the differences between these specimens and those from Taramajima, though slight, are constant, I have thought it best to signalize them by a name.

*Clausilia dæmonorum* Pils. Pl. LVII, figs. 98, 99.

Proc. A. N. S. Phila., 1902, p. 381.

Having only fossil specimens without the clausilium, I described this species originally as a *Stereophædusa*. Recent discoveries by Mr. Hirase have now made it clear that there exists a group of species closely related to *Zaptyx*, in which the inferior lamella is spiral within. The types of *C. dæmonorum* show, now that they are more perfectly cleaned, *two sutural plicæ*, which I did not see when originally describing the species.

*C. dæmonorum* differs from *C. kikaiensis* in the more swollen, sack-like base, larger superior lamella and the less immersed, spirally ascending inferior lamella.

The species is apparently extinct in the type locality, Kikaiga-shima, a small, low island which has been pretty thoroughly examined for land shells; but a closely related living form has been sent from Tokunoshima.

The figures are drawn to a smaller scale than the others on the same plate.

*C. dæmonorum viva* n. subsp. Pl. LVII, figs. 89, 90, 91, 92.

Shell cylindric below, tapering from the penultimate whorl to the apex, pale yellow or brownish-yellow, more or less transparent; thin. Surface glossy, with low wrinkles of growth, and behind the lip some stronger striae. Whorls  $8\frac{1}{2}$ , those of the spire quite convex, the last two somewhat flattened; last whorl compressed laterally, *very convex and sack-like below*. Aperture trapezoidal-ovate, the sinulus a little retracted; lip thin, expanded and narrowly reflexed, white. Superior lamella marginal, small, vertical and compressed, continuous with the spiral lamella which is low and delicate. Inferior lamella receding, forming a high compressed fold and approaching the superior lamella in the throat; within the back of the last whorl it is dilated and ascends in a broadly spiral curve. It is short within, and does not run parallel to the spiral lamella. The subcolumellar lamella emerges. The fulcrum and parallel lamella are very small. The principal plica is about

one-third of a whorl long. The upper palatal plica is very short, and connected with the very oblique and curved lunella. There are two weak sutural plicæ.

Length 9.8, diam. 2.2 mm.

Length 9.5, diam. 2 mm.

The clausilium (Pl. LVII, figs. 90, 91) is rather short, wider below than above, and strongly curved near the rounded apex; it is abruptly and deeply excised near the filament, as usual.

Bomayama, Tokunoshima, Ōsumi. Types No. 87,588, A. N. S. P., from No. 1,201 of Mr. Hirase's collection.

This little *Clausilia* has much in common with the fossil *C. daemorum* of Kikaiga-shima, but it is somewhat less specialized in having the superior and spiral lamellæ continuous. The upper of the two sutural plicæ is very weak, and in some specimens hardly perceptible. In one opened I saw a very weak *lamella inserta*.

#### Section PARAZAPTYX nov.

The shell is similar to *Zaptyx*, except that the inferior and subcolumellar lamellæ ascend spirally, as in *Metazaptyx*; fulcrum and parallel lamella and sutural plicæ are absent. The clausilium is wide, *tapers strongly to the apex*, and is strengthened by a transverse lamellar rib on the convex side.

The extraordinary clausilium of this group finds no parallel in Asiatic *Clausiliidae*. *Parazaptyx* is another of the highly specialized phyla of the Riukiu Islands which give evidence of the ancient origin of these insular faunas.

In its spirally ascending lamellæ and wide clausilium, this Section resembles *Metazaptyx*, but it is like *Hemizaptyx* in lacking accessory plicæ, and the clausilium is unique.

#### *Clausilia thaumatopoma* n. sp. Pl. LVII, figs. 100, 101, 102, 103, 104.

Shell cylindric below, the upper half tapering and a little attenuated near the apex; brown, the apex pale. Whorls 9, convex, the first two smooth, the second whorl disproportionately wide; third and subsequent whorls closely, finely and sharply striate, shining, the striation coarser behind the lip. The aperture is trapezoidal-ovate, retracted at the sinulus, not projecting, brown inside; the peristome is pale-edged, very narrowly reflexed, obtuse but hardly thickened. The superior lamella is subvertical, marginal, rather high, and continuous with the low spiral lamella, which penetrates to the middle of the ventral side. The inferior lamella recedes very deeply, and is not visible in a front

view, though seen obliquely from the base it appears as a rather high thin lamella. Within it ascends in a widely spiral curve. The subcolumellar lamella emerges to the lip-edge, and ascends in a sigmoid curve. The principal plica is about a half whorl long, dorsal and lateral. The upper palatal plica is very oblique, and weakly joined to the lunella, which is oblique, straight above, arcuate, curving inward below.

Length 10.5, diam. 2.5 mm.

Clausilium (Pl. LVII, figs. 100, 101, 104) short and wide, well curved, at the distal end tapering to a blunt apex, somewhat excavated on the palatal side. It is deeply excised on the columellar side of the filament. On the outer, convex surface there is a transverse plate extending from side to side.

Kumejima, Ryukyu. Types No. 87,631, A. N. S. P., from No. 1,293 of Mr. Hirase's collection.

Externally this species is much like the striate species of *Zaptyx*, but the sigmoid lamellæ and unique clausilium distinguish it.

#### Section OLIGOZAPTYX nov.

The shell is very small, fusiform, with no superior lamella. The inferior lamella forms a squarish fold in the throat and the subcolumellar lamella is obsolete below. There is a long lower palatal plica and short upper united with the lunella. Sutural plicæ and a lamella fulcrans are developed. The clausilium is notched on the palatal side of the projecting apex, and excised on the columellar side of the filament.

Type *C. hedleyi*.

In this extraordinary phylum the clausilium resembles that of *Diceratoptyx*, while the palatal armature is totally unlike any other known Zaptychoid form by the development of a large lower palatal plica. The whole closing apparatus is of a highly evolved type.

*Clausilia hedleyi* n. sp. Pl. LVII, figs. 105-110.

Shell very small, *fusiform*, attenuated above, amber-colored, transparent; *almost smooth*, with a brilliant gloss, the last whorl slightly striate behind the lip. Whorls  $7\frac{3}{4}$ , convex, the last narrow and tapering downward. Aperture projecting free in front, piriform, the white lip narrowly reflexed. *Superior lamella obsolete*, represented merely by a slight thickening of the peristome. Spiral lamella small, low and short, lateral. Inferior lamella receding, forming a strongly projecting squarish and bifid fold in the throat, low within. Subcolumellar

lamella wholly immersed, subobsolete. Principal plica long, extending from a ventral position nearly to the aperture. Lunella lateral, united to the middle of a long, curved lower palatal plica, and with its upper end continued inward in a shorter upper palatal plica, much as in *C. platydera* and its allies. There are two minute sutural plicæ and a short *lamella fulcrans*.

Length 7.8, diam. 1.7 mm.

Clausilium (Pl. LVII, figs. 105, 106, 107, 108) rather short, parallel-sided, abruptly bent at the apex and twisted into a sort of spout, notched on the palatal side of the projecting apex.

Tokunoshima, Ōsumi, at Matsubara. Types No. 87,589, A. N. S. P., from No. 1,202 of Mr. Hirase's collection.

This is one of the smallest as well as one of the most specialized of Asiatic Clausiliæ. It is named in honor of my friend, Charles Hedley.

The clausilium is both abruptly curved and twisted near the apex, so that its true shape is not easily conveyed by figures. The apical end, however, is well shown by figs. 105 and 108, while it is seen much foreshortened in figs. 106 and 107.

#### Section DICERATOPTYX nov.

The glossy shell is Zaptychoid, the superior lamella developed, inferior lamella receding, calloused below. Subcolumellar lamella rising high on the palatal wall, dilated in a lateral position. *Upper palatal plica very long*, an *extremely short lunella* descending from near its inner end. Lamella fulcrans and parallela and sutural plicæ are developed. Clausilium deeply excised as usual at the filament, and with a deep notch excavated near the apex on the palatal side.

The very long upper palatal plica and diminutive lunella, and the peculiar clausilium, are characteristic. The dilated subcolumellar lamella, which rises high on the palatal wall, takes the place of a lower palatal plica.

The clausilium resembles that of *Oligozaptyx*, but the notch near the distal end has been independently evolved in the two groups; that of *Diceratoptyx* being adapted to fit over the dilated subcolumellar lamella, while in *Oligozaptyx* the notch fits over the lower palatal plica, and has been evolved with the evolution of the latter.

The internal structure is partially shown in Pl. LVII, fig. 113: *f*, fulcrum; *p*, parallel lamella; *sp*, spiral lamella; *inf*, inferior lamella; *sc*, subcolumellar lamella. The characteristic dilation of the latter is well shown, as well as its course upon the palatal wall of the shell, through which it is seen by transparency.

*Clausilia cladoptyx* n. sp. Pl. LVII, figs. 111-115.

Shell cylindric below, the upper half regularly tapering; amber or brownish-amber colored; almost entirely smooth, with a varnish-like gloss. Whorls 9, quite convex. Aperture ovate; peristome reflexed, slightly thickened. Superior lamella small, vertical, marginal, contiguous to or continuous with the spiral lamella, which penetrates nearly to the ventral side. Inferior lamella more or less receding, forming a very strong fold in the throat, ascending in a *very broad sigmoid plate*, abruptly diminishing to a small thread above, which revolves parallel to the spiral lamella, but does not penetrate so deeply. Subcolumellar lamella emerging to the lip-edge; inside it dilates, rising in an angle in a lateral position. Outside of the spiral lamella there are two short equal, parallel lamellæ (*lamella fulcrans* and *l. parallela*). The principal plica is dorsal and lateral, visible in the throat, and nearly a half whorl long; below it there is a very long upper palatal plica, which at its inner end gives out a very short oblique branch downward, the lunella. Below this there is a short palatal plica, at least in some specimens. Above the principal plica there are two sutural plicæ, the lower one well developed, the upper small.

Length 10, diam. 2.2 mm.

Length 9, diam. 2 mm.

The clausilium (Pl. LVII, figs. 111, 112) is short and wide, parallel-sided; there is a deep semicircular notch near the apex on the palatal side, and a deep excision on the columellar side of the filament. A marginal rib runs along the columellar side from the excision to the notch.

Tokunoshima, at Teteiyama, near Sanmura. Types No. 87,592, A. N. S. P., from No. 1,204a of Mr. Hirase's collection.

Specimens from Sanmura, Tokunoshima, differ from typical *C. cladoptyx* in the smaller size: length 9, diam. 2 mm. to length 7.5, diam. 1.8 mm.

The plicæ are visible from the outside through the shell, as in *Oligozaptyx*.

## EUPHÆDUSOID PHYLUM.

## Section EUPHÆDUSA Bttg.

*Clausilia tryoni* var. *miyakejimana* subsp. nov.

This race differs from *C. tryoni* in having two or three small, short palatal plicæ below the upper one. The striation of the last whorl is also denser and finer.

Miyakejima, Izu. Types No. 86,464, A. N. S. P., from No. 1,068 of Mr. Hirase's collection.

## EXPLANATION OF PLATES LII-LVII.

PLATE LII, Figs. 1, 2, 3.—*Clausilia ophidoön* Pils.

Figs. 4, 5.—*Clausilia tokunoshimana* Pils.

Figs. 6, 7.—*Clausilia azumai* Pils.

Fig. 8.—*Clausilia azumai idiopylis* Pils.

Figs. 9, 10, 11.—*Clausilia nakadai* Pils.

Fig. 12.—*Clausilia nakadai degenerata* Pils.

Figs. 13, 14.—*Clausilia okinoerabuensis* Pils.

PLATE LIII, Figs. 15, 16.—*Clausilia ophidoön* Pils. Clausilium.

Figs. 17.—*Clausilia azumai idiopylis* Pils. Clausilium.

Figs. 18, 19.—*Clausilia nakadai* Pils. Clausilium.

Figs. 20, 21.—*Clausilia tokunoshimana* Pils. Clausilium.

Fig. 22.—*Clausilia nakadai degenerata* Pils. Clausilium.

Figs. 23, 24.—*Clausilia okinoerabuensis* Pils. Clausilium.

PLATE LIV, Figs. 25, 26, 27, 28.—*Clausilia nagashimana* Pils.

Figs. 29, 30, 31, 32, 33.—*Clausilia cymatodes* Pils.

Figs. 34, 35, 36, 37.—*Clausilia subhickonis* Pils.

Fig. 38.—*Clausilia subhickonis*, variety.

Fig. 39.—*Clausilia mikawa* Pils., palatal aspect.

Figs. 40, 41.—*Clausilia mikawa* Pils., type.

PLATE LV, Figs. 42, 43, 44.—*Clausilia asperata* Pils.

Figs. 45, 46.—*Clausilia ikiensis* Pils.

Figs. 47, 48, 49.—*Clausilia purissima* Pils.

Figs. 50, 51.—*Clausilia ikiensis* Pils. Clausilium.

Fig. 52.—*Clausilia aurantiaca sakui* Pils.

Figs. 53, 54, 55, 56, 57.—*Clausilia koshikijimana* Pils.

Figs. 58, 59, 60.—*Clausilia ventriluna* Pils.

Figs. 61, 62, 63.—*Clausilia hosayaka* Pils.

PLATE LVI, Figs. 64, 65, 66, 67.—*Clausilia hirasei* Pils.

Figs. 68, 69, 70, 71.—*Clausilia kikaiensis* Pils.

Figs. 72, 73, 74, 75.—*Clausilia sarissa* Pils.

Figs. 76, 77, 78, 79.—*Clausilia hyperoptyx* Pils.

Figs. 80, 81, 82, 83, 84.—*Clausilia yaeyamensis* Pils.

Figs. 85, 86, 87, 88.—*Clausilia hyperoptyx* Pils.

PLATE LVII, Figs. 89, 90, 91, 92.—*Clausilia daemonorum viva* Pils.

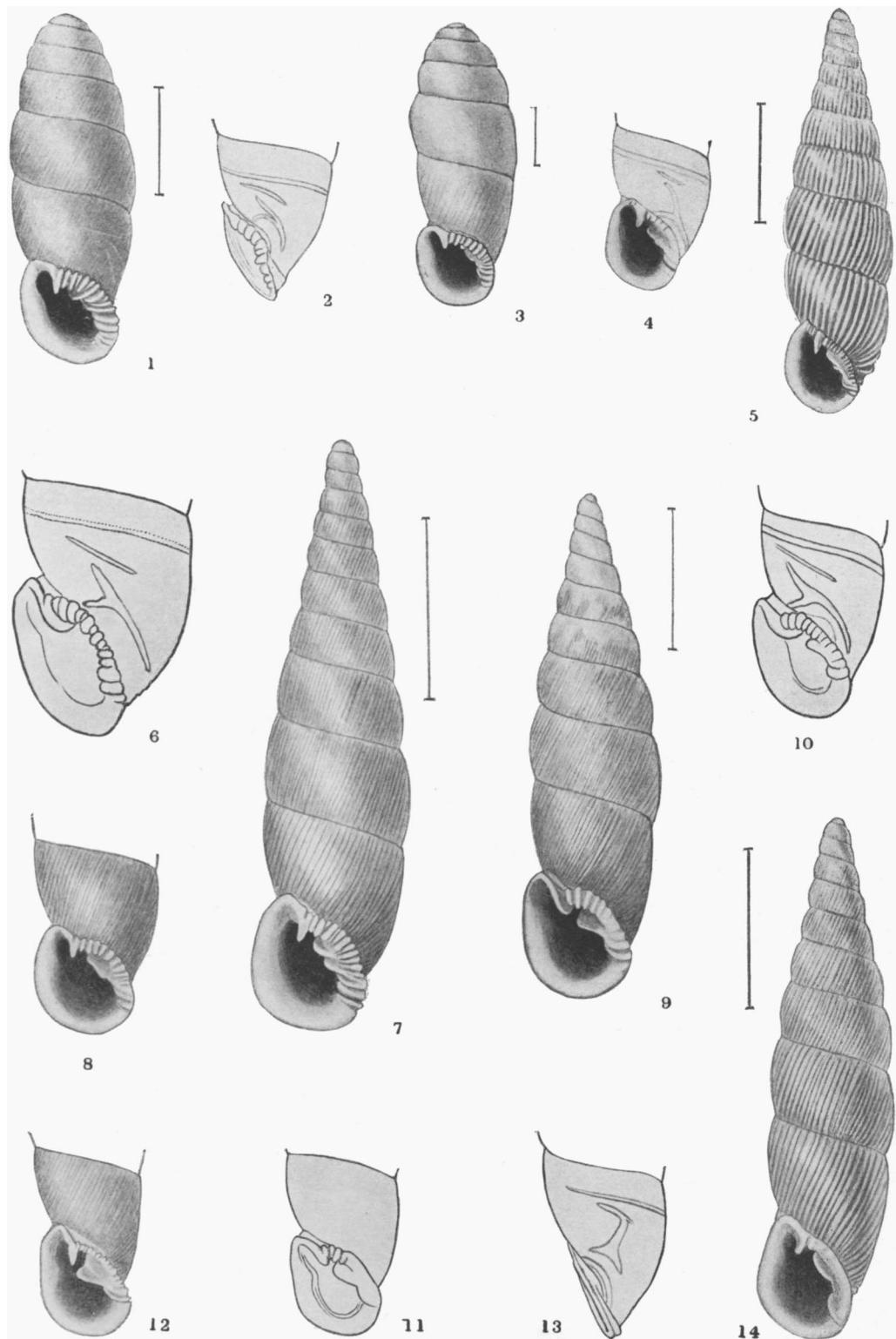
Figs. 93, 94, 95, 96, 97.—*Clausilia pattalus* Pils.

Figs. 98, 99.—*Clausilia daemonorum* Pils. These figures are drawn to a smaller scale than the others on the plate.

Figs. 100, 101, 102, 103, 104.—*Clausilia thaumatopoma* Pils.

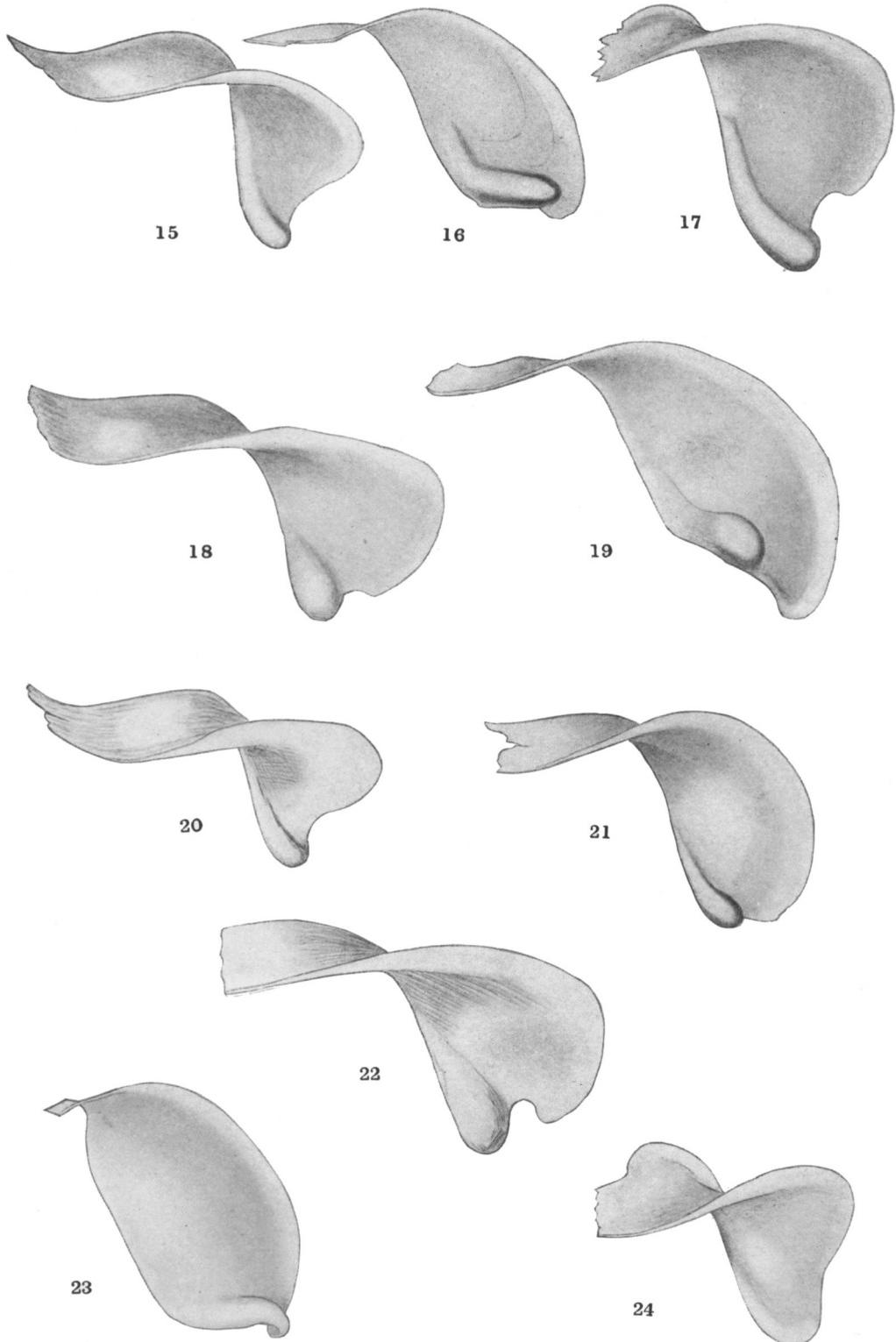
Figs. 105, 106, 107, 108, 109, 110.—*Clausilia hedleyi* Pils.

Figs. 111, 112, 113, 114, 115.—*Clausilia cladoptyx* Pils



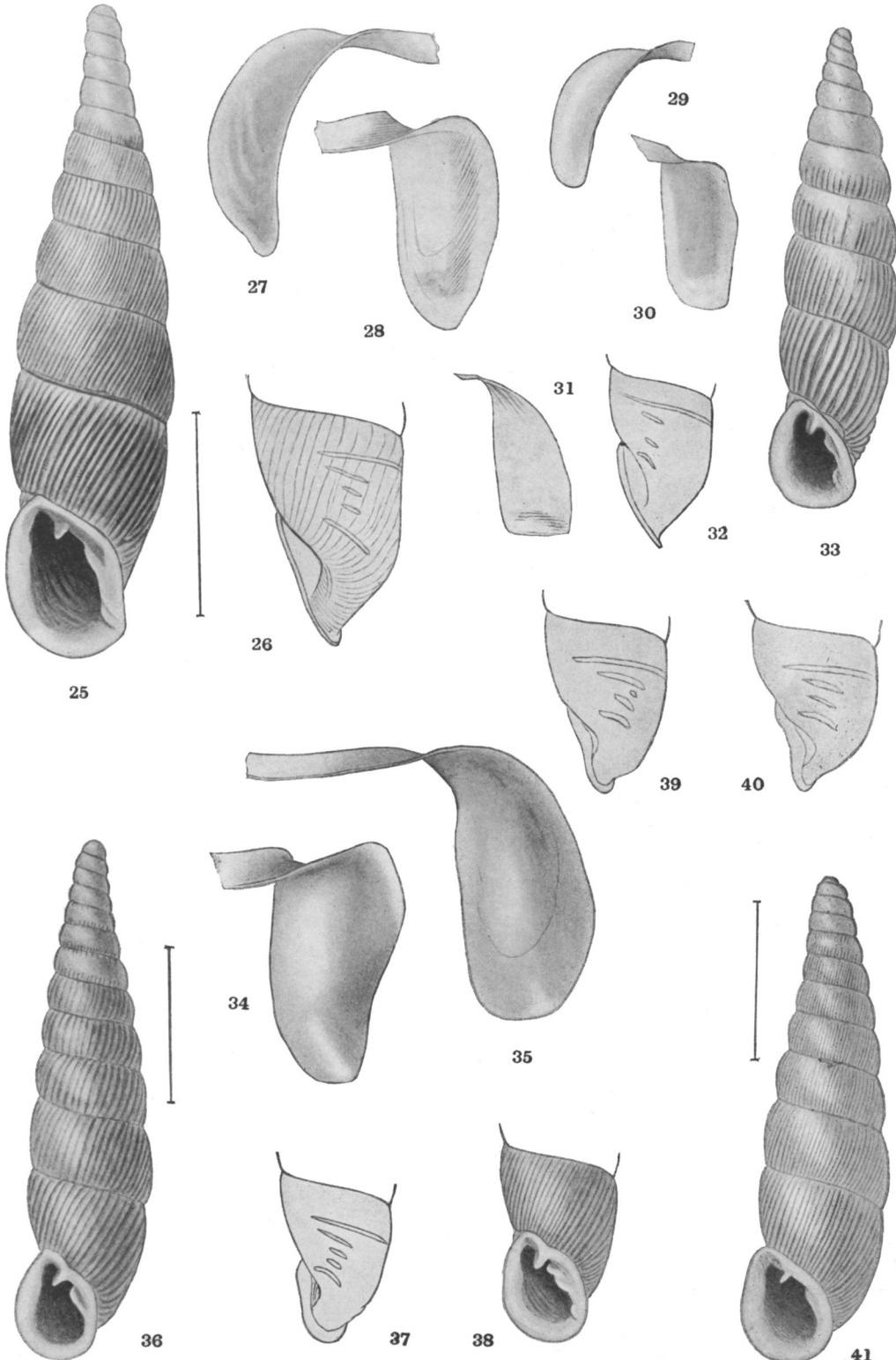
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PILSBRY. NEW JAPANESE CLAUSILIIDÆ.



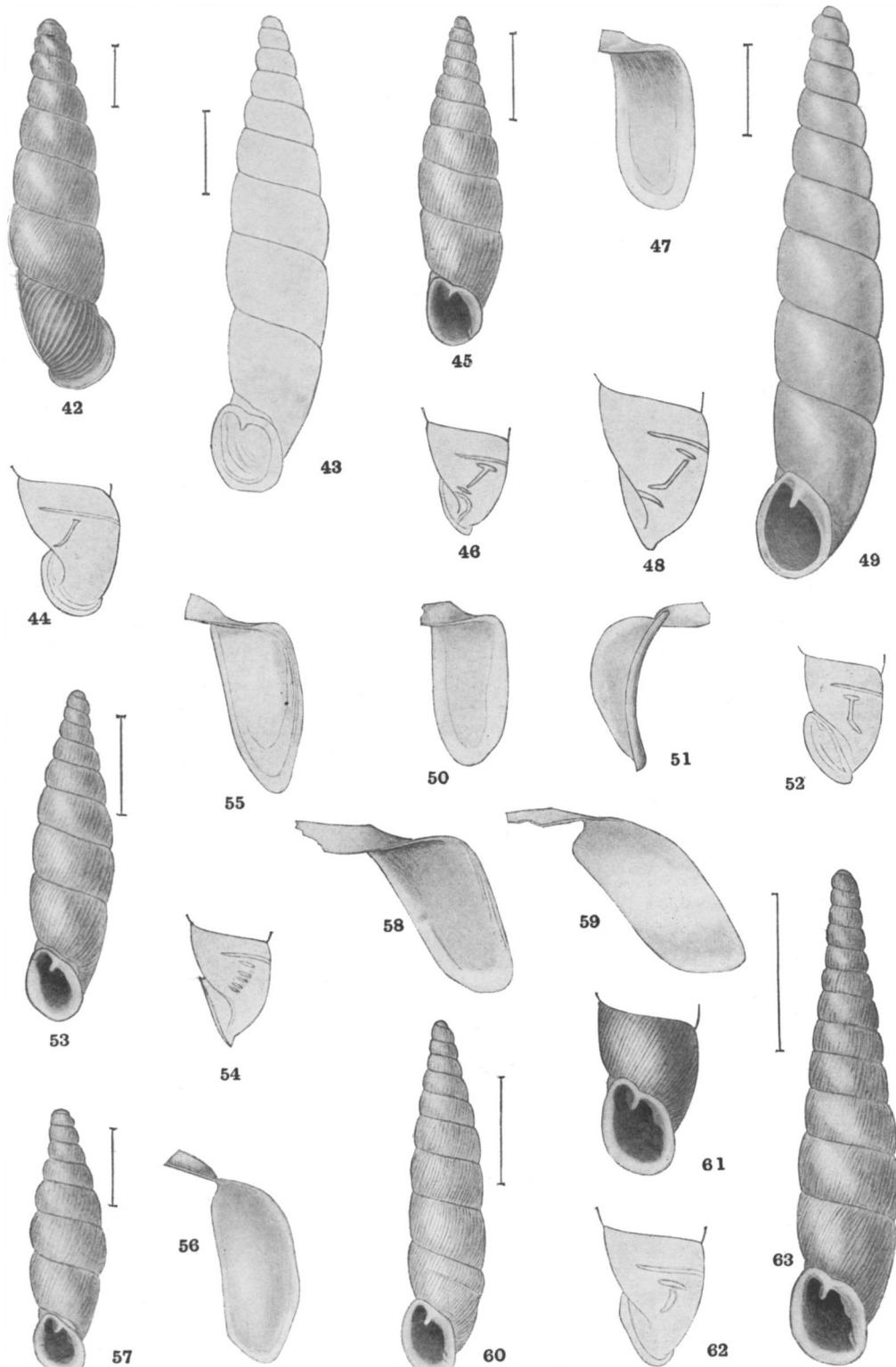
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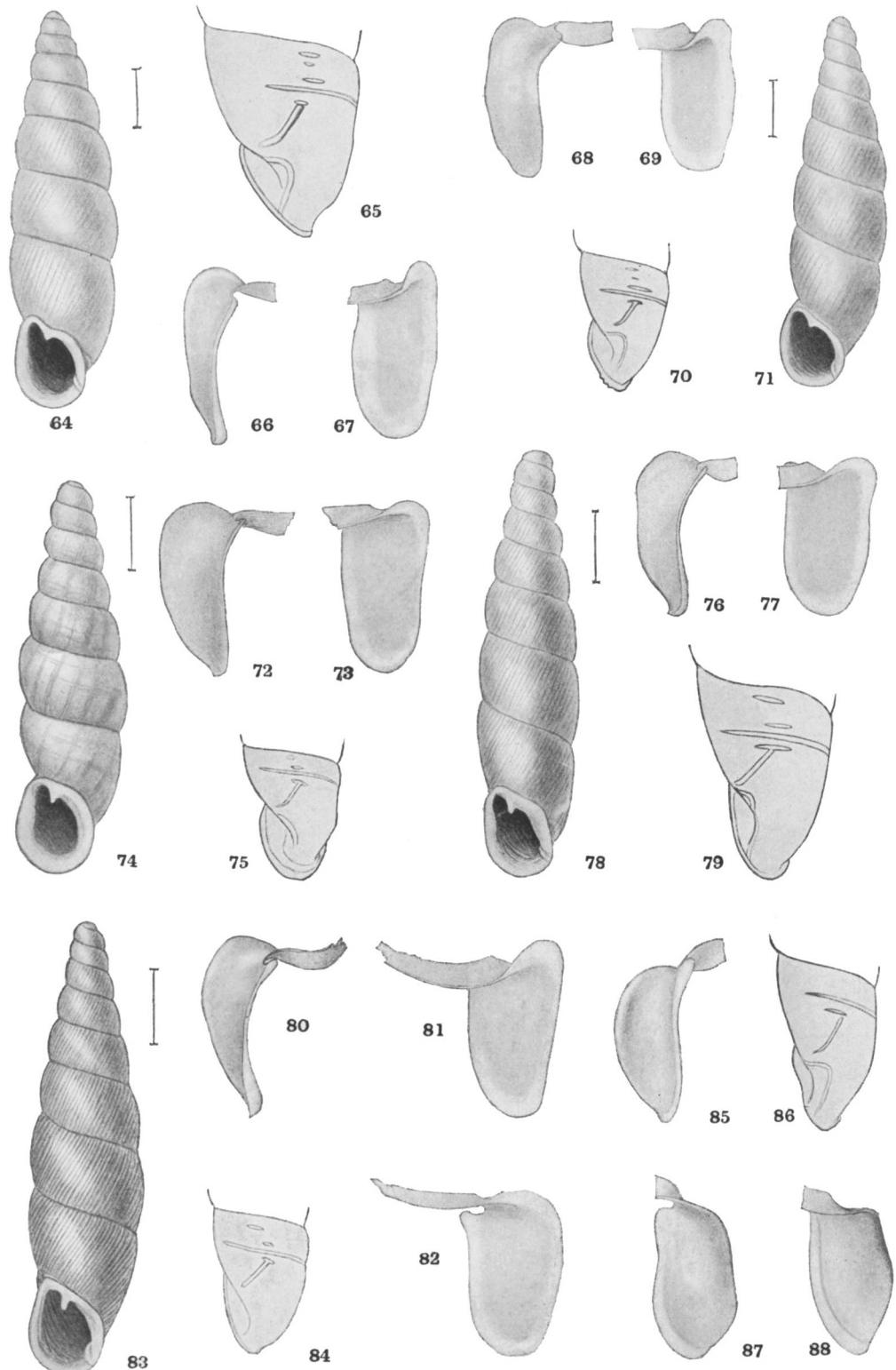
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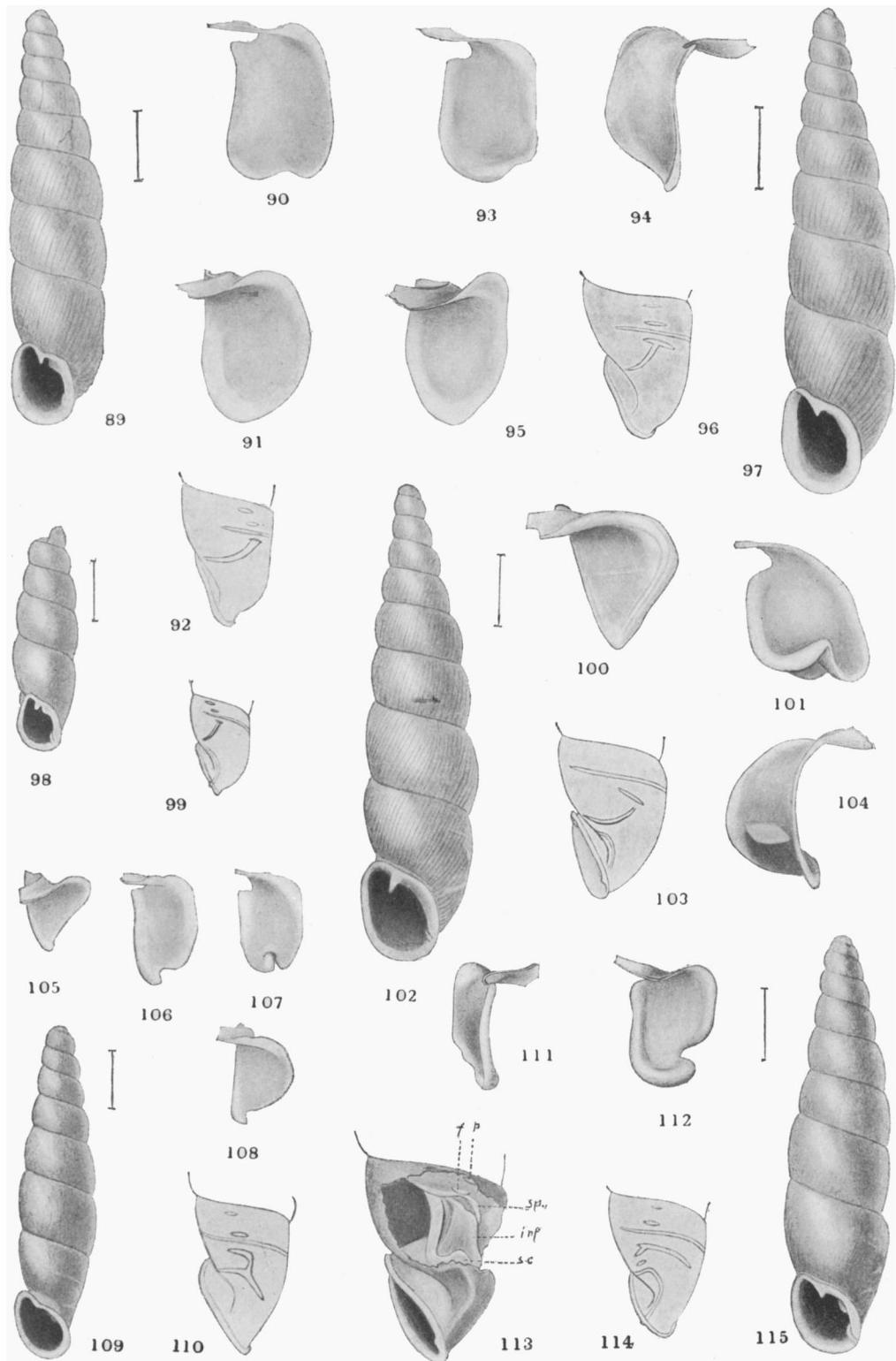
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